Geometric freedom for constructing variable size photonic bandgap structures

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In order to study the design flexibility of photonic bandgap structures we investigate different examples of 1D, 2D and 3D structures as traditional Bragg layers, 2D photonic crystals, and 3D woodpile structures. It turns out that in systems with large gaps evanescent waves penetrate into the bulk only distances comparable to one lattice constant, therefore confinement of light can also be achieved *without* long range order, which leads to the introduction of novel photonic band gap designs. Adhering to some constraints the changes in the photonic band gap in disordered structures are negligible. The important quantity to characterize the presence respectively absence of modes is the local photonic density of states, however band gap phenomena in size and position disordered arrangements can also be verified with plane wave supercell calculations as well as finite difference time domain techniques.

[1] J. Zarbakhsh, F. Hagmann, S. F. Mingaleev, K. Busch, and K. Hingerl, Appl. Phys. Lett. **84**, 4687 (2004).